What is claimed is:

1. An exposure apparatus for exposing with X-rays a pattern present on a mask onto a photosensitive substrate, comprising:

a. an optical system having a plurality of reflective surfaces arranged so as to guide the X-rays to the mask and to transfer the mask pattern onto the photosensitive substrate; and

b. a detection apparatus arranged adjacent one of said reflective surfaces and designed to detect photoelectrically generated electrons from said one of said reflective surfaces when said one of said reflective surfaces is irradiated with the X-rays, and to provide a first output signal corresponding to an amount of said photoelectrically generated electrons detected.

2. An exposure apparatus according to claim 1, further including:

a. an exposure dose calculation apparatus, electrically connected to said detection apparatus, for calculating based on said first output signal, an exposure dose of the X-rays at the mask and capable of generating a second output signal corresponding thereto; and

b. an X-ray limiting apparatus electrically connected to said exposure dose calculation apparatus, for controlling the illumination of the X-rays based on said second output signal.

3. An exposure apparatus according to claim 1, further including:

a. an exposure dose calculation apparatus, electrically connected to said detection apparatus, for calculating based on said first output signal, an exposure dose of the X-rays at the photosensitive substrate and capable of generating a second output signal corresponding thereto; and

b. an X-ray limiting apparatus electrically connected to said exposure dose calculation apparatus, for controlling the illumination of the X-rays based on said second output signal.

4. An exposure apparatus according to claim 1, wherein said optical system further includes a plurality of optical elements, and a detection apparatus designed so as to detect a deterioration in one or more optical characteristics of at least one of a reflective surface and an optical element in said plurality of reflective surfaces and said plurality of optical elements.

5. An exposure apparatus according to claim 1, wherein said detection apparatus has one of a grounded ammeter and voltmeter.

6. The exposure apparatus according to claim 1, wherein said one of said reflective surfaces further comprises a film made of a material selected from one or more materials from the group of materials comprising: molybdenum, ruthenium, rhodium, silicon and silicon oxide.

7. An exposure apparatus according to claim 5, wherein said detection apparatus further comprises an electrode member having a positive electric potential with respect to said ground and is arranged in the vicinity of said one of said reflective surfaces.

8. An exposure apparatus according to claim 1, further including:

a. a mask stage capable of holding the mask

b. a substrate stage capable of holding the photosensitive substrate;

c. a projection optical system arranged between said mask stage and said substrate stage; and

d. a drive apparatus capable of moving said mask stage and said substrate stage relative to said projection optical system.

9. An exposure apparatus according to claim 1, further including:

a. a deformation quantity calculation apparatus that calculates an amount of deformation of at least one reflective surface of said plurality of reflective surfaces based on said first output signal, and which generates a second output signal corresponding to said amount of deformation;

b. an adjustment quantity calculation apparatus, electrically connected to said deformation quantity calculation apparatus, that calculates an amount of adjustment of said at least one reflective surface necessary to eliminate said amount of deformation based on said second output signal, and generates a third output signal corresponding to said amount of adjustment; and

c. an adjustment apparatus, electrically connected to said adjustment quantity calculation apparatus, that adjusts said at least one reflective surface based on said third output signal, so as to eliminate said amount of deformation from at said least one reflective surface.

10. An exposure apparatus for exposing a pattern present on a mask onto a photosensitive substrate, comprising:

a. an X-ray radiation source that generates X-rays;

b. an illumination optical system that guides said X-rays to the mask;

c. a projection optical system having a plurality of reflective surfaces arranged so as to guide said X-rays from the mask to transfer the mask pattern onto the photosensitive substrate; and

d. a detection apparatus arranged adjacent one of said reflective surfaces and designed to detect photoelectrically generated electrons from said one of said reflective surfaces when said one of said reflective surfaces is irradiated with said X-rays, and to provide a first output signal corresponding to an amount of said photoelectrically generated electrons detected.

11. An exposure apparatus according to claim 10, further including:

a. a deformation quantity calculation apparatus that calculates an amount of deformation of at least one reflective surface of said plurality of reflective surfaces based on said first output signal, and which generates a second output signal corresponding to said amount of deformation;

b. an adjustment quantity calculation apparatus, electrically connected to said deformation quantity calculation apparatus, that calculates an amount of adjustment of said at least one reflective surface necessary to eliminate said

amount of deformation based on said second output signal, and generates a third output signal corresponding to said amount of adjustment; and

c. an adjustment apparatus, electrically connected to said adjustment quantity calculation apparatus, that adjusts said at least one reflective surface based on said third output signal, so as to correct said amount of deformation of said least one reflective surface.

12. The exposure apparatus according to claim 10, wherein said one of said reflective surfaces further comprises a film made of a material selected from one or more materials from the group of materials comprising: molybdenum, ruthenium, rhodium, silicon and silicon oxide.

13. An exposure apparatus comprising:

a. an X-ray radiation source that generates X-rays;

b. an optical system that guides said X-rays to a mask having a first pattern, and then to a photosensitive substrate so as to form on the photosensitive substrate the pattern of the mask, said optical system including an optical element that exhibits a photoelectric effect upon irradiation by said X-rays when said optical element is arranged in an optical path between said X-ray radiation source and said photosensitive substrate; and

c. a detection apparatus arranged relative to said optical element so as to detect photoelectrically generated electrons from said optical element, and which provides a first output signal corresponding to an amount of said photoelectrically generated electrons detected.

14. An exposure apparatus according to claim 13 further including:

a. an exposure dose calculation apparatus electrically connected to said detection apparatus, that calculates an exposure dose of X-rays at the mask based on said first output signal, and generates a second output signal corresponding to said calculated exposure dose; and

b. an X-ray limiting apparatus that limits the guidance of X-rays to the mask based on said second output signal.

15. An exposure apparatus according to claim 13, further including:

a. an exposure dose calculation apparatus, electrically connected to said detection apparatus, for calculating, based on said output signal, an exposure dose of said X-rays at the photosensitive substrate and for generating a second output signal corresponding thereto; and

b. an X-ray limiting apparatus electrically connected to said exposure dose calculation apparatus, for controlling the illumination of said X-rays based on said second output signal.

16. An exposure apparatus according to claim 13, wherein said optical system further includes a plurality of optical elements, and a detection apparatus designed so as to detect a deterioration in one or more optical characteristics of at least one of a reflective surface and an optical element in said plurality of reflective surfaces and said plurality of optical elements.

17. An exposure apparatus according to claim 13, further including:

a. a deformation quantity calculation apparatus that calculates an amount of deformation of at least one reflective surface of said plurality of reflective surfaces based on said first output signal, and which generates a second output signal corresponding to said amount of deformation;

b. an adjustment quantity calculation apparatus, electrically connected to said deformation quantity calculation apparatus, that calculates an amount of adjustment of said at least one reflective surface necessary to eliminate said amount of deformation based on said second output signal, and generates a third output signal corresponding to said amount of adjustment; and

c. an adjustment apparatus, electrically connected to said adjustment quantity calculation apparatus, that adjusts said at least one reflective surface based on

said third output signal, so as to correct said amount of deformation of said least one reflective surface.

18. The exposure apparatus according to claim 13, wherein said detection apparatus has one of a grounded ammeter and voltmeter.

19. An exposure apparatus according to claim 18, wherein said detection apparatus further comprises an electrode member having a positive electric potential with respect to said ground and is arranged in the vicinity of said one of said reflective surfaces.

20. An exposure apparatus according to claim 13, further including:

a. a mask stage capable of holding the mask;

b. a substrate stage capable of holding the photosensitive substrate;

c. a projection optical system arranged between said mask stage and said substrate stage; and

d. a drive apparatus capable of moving said mask stage and said substrate stage relative to said projection optical system.

21. A method for controlling radiation exposure dose in a photolithographic process comprising the steps of:

a. monitoring photoelectrically generated electrons from at least one reflective surface of a plurality of reflective surfaces in relative alignment used during a photolithographic exposure process;

b. determining from said monitoring if the exposure dose meets one or more predefined parameters; and

c. stopping the radiation exposure when the exposure dose meets said one or more predefined parameters.

22. An exposure dose control method of claim 21, further comprising the steps of:

a. determining from said monitoring if loss of alignment in said plurality of reflective surfaces is occurring; and

b. adjusting a position of at least one of said reflective surfaces to realign said plurality of reflective surfaces.

23. The exposure control method of claim 21, wherein said monitoring is conducted during an x-ray radiation exposure process.

24. A method for controlling radiation exposure dose in a photolithographic process comprising the steps of:

a. monitoring photoelectrically generated electrons from at least one optical element of a plurality of optical elements used during a photolithographic exposure process;

b. determining from said monitoring if the exposure dose meets one or more predefined parameters; and

c. stopping the radiation exposure when the exposure dose meets said one or more predefined parameters.

25. The exposure control method of claim 24, wherein said monitoring is conducted during an x-ray radiation exposure process.

26. A method for controlling contamination in a radiation generation and transmission apparatus, comprising the steps of:

a. monitoring at least one optical element used during a radiation generation and transmission process for photoelectrically ejected electrons, wherein said at least one optical element is subject to contamination from said radiation generation and transmission process;

b. determining from said monitoring if contamination of said at least one optical element has exceeded a predetermined level; and

c. providing for the maintenance or replacement of said at least one optical element when contamination has exceeded said predetermined level.

27. The method of controlling contamination of claim 26 wherein said radiation and generation and transmission process generates x-rays.

28. A method for controlling contamination in a radiation exposure unit comprising the steps of:

a. monitoring a least one optical element used during a radiation exposure process for photoelectrically generated electrons, wherein said at least one optical element is subject to contamination from the radiation exposure process;

b. determining from said monitoring if contamination of said at least one optical element exceeds a predetermined level; and

c. providing for the maintenance or replacement of said at least one optical element when contamination exceeds said predetermined level.

29. The method of controlling contamination of claim 28, wherein monitoring further comprises monitoring during an x-ray radiation exposure process.

30. A method for controlling contamination in a radiation exposure unit comprising the steps of:

a. monitoring a least one reflective surface used during a radiation exposure process for photoelectrically generated electrons, wherein said at least one reflective surface is subject to contamination from the radiation exposure process;

b. determining from said monitoring if contamination of said at least one reflective surface exceeds a predetermined level; and

c. providing for the maintenance or replacement of said at least one reflective surface when contamination exceeds said predetermined level.

31. The method of controlling contamination of claim 30, wherein said monitoring further comprises monitoring during an x-ray radiation exposure process.

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